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APPLICATION NUMBER: 10/339,485

FILING DATE: January 09, 2003

RELATED PCT APPLICATION NUMBER: PCT/US04/00385

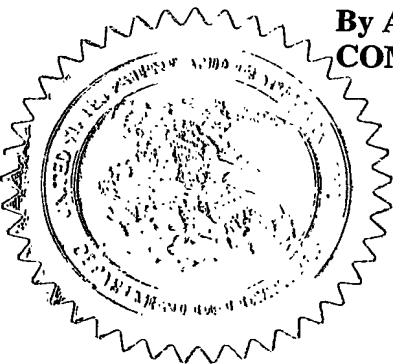
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PATENT &amp; TRADEMARK OFFICE

# UTILITY PATENT APPLICATION TRANSMITTAL

<b>Address to:</b> <b>Box PATENT APPLICATION</b> <b>Commissioner for Patents</b> <b>United States Patent &amp; Trademark Office</b> <b>Washington, D.C. 20231</b>	<i>Attorney Docket No.</i>	STYL 0162 PUS
	<i>Inventor(s) or Appln. Identifier</i>	Barry Rosenbaum Frances Fesuk

95257 S. PARK OFF

10/339485



1. This application entitled "Erasable Ink for a Writing Implement" is:
- a. X A new application under 37 C.F.R. § 1.53(b).
- b.      A      continuation      divisional or      continuation-in-part application under 37 C.F.R. § 1.53(b) of prior application Serial No.      /      filed on             , entitled             .
- c.      A new utility application which claims the benefit of provisional application Serial No.     , filed on             .

**Application elements and other attached papers:**

2.   X   Specification (including Claims and Abstract) [Total Pages 21 ]
3.        Drawings (    informal /    formal) [Total Sheets    ]
4.        Oath or Declaration
  - a.        Newly-executed
  - b.        Copy from a prior application (37 C.F.R. § 1.63(d))
5.        Incorporation By Reference: The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Item 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6.        This application is filed by fewer than all the inventors named in the prior application, 37 C.F.R. § 1.53(d)(4).
  - a.        **DELETE** the following inventor(s) named in the prior nonprovisional application:  

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  - b.        The inventor(s) to be deleted are set forth on a separate sheet attached hereto.

**CERTIFICATION UNDER 37 C.F.R. § 1.10**

I hereby certify that this UTILITY PATENT APPLICATION TRANSMITTAL and the documents referred to as attached therein are being deposited on the below date with the United States Postal Service in an envelope as "Express Mail Post Office to Addressee" addressed to: Box Patent Application, Commissioner for Patents, United States Patent and Trademark Office, Washington, D.C. 20231 on:

Express  
Mail Label No. EV 212246284 US

**Date of Deposit:** January 9, 2003

Denise Sinnhuber  
(Type or print name of person mailing paper)

(Type or print name of person mailing paper)  
Debbie S. Schubert  
 (Signature of person mailing paper)

Atty. Dkt. No.: STYL 0162 PUS

## 7. Preliminary Amendment:

- a. ☐ A Preliminary Amendment Under 37 C.F.R. § 1.115 is attached.
- b. ☐ Cancel in this application original claims \_\_\_\_\_ of the prior application before calculating the filing fee.
- c. ☐ Please amend the specification by inserting before the first line the following sentence:  
       "This is a \_\_\_\_\_ continuation \_\_\_\_\_ divisional of copending  
       application(s) serial number / \_\_\_\_\_ filed on \_\_\_\_\_."
- d. ☐ A Petition to Suspend Prosecution For The Time Necessary to File An Amendment (New Application Filed Concurrently) is attached.

## 8. Small entity status:

- a. ☒ Applicant claims small entity status.
- b. ☐ Small entity status was claimed in the prior nonprovisional application and such status is still proper and desired.
- c. ☐ Is no longer desired.

## 9. Fee Calculation:

FOR	NUMBER FILED	NUMBER EXTRA	RATE	CALCULATIONS
TOTAL CLAIMS (37 C.F.R. § 1.16(c))	46 -20 =	26	x 18.00	468.00
INDEPENDENT CLAIMS (37 C.F.R. § 1.16(b))	-3 =		x 84.00	
MULTIPLE DEPENDENT CLAIMS (if applicable) (37 C.F.R. §1.16(d))			280.00	
BASIC FEE (37 C.F.R. § 1.16(a))				750.00
TOTAL OF ABOVE CALCULATIONS				1,218.00
REDUCTION BY 50% FOR FILING BY SMALL ENTITY (NOTE 37 C.F.R. §§ 1.9, 1.27, 1.28)				609.00
\$40.00 ASSIGNMENT RECORDAL FEE (if applicable)				
TOTAL				609.00

10. ☒ A check in the amount of \$ 609.00 is enclosed.
11. ☒ The Commissioner is hereby authorized to credit overpayments or charge the following fees (or any deficiency therein) to Deposit Account No. 02-3978 :
- a. ☒ Fees required under 37 C.F.R. § 1.16.
- b. ☒ Fees required under 37 C.F.R. § 1.17.
12. Maintenance of Copendency of Prior Application

☐ A request for extension of time and the appropriate fee have been filed in the pending prior application (or are being filed in the prior application concurrently herewith) to extend the period for response until \_\_\_\_\_.

Atty. Dkt. No.: STYL 0162 PUS

13. X An Information Disclosure Statement (IDS) is attached, along with the following indicated attachments thereto:
- a. X Form PTO/SB/08 (one sheet(s))
- b. X Copies of references cited
14.        Certified copy of priority document(s)
15.        Nonpublication Request Under 37 C.F.R. § 1.213(a)
16.        Request for Early Publication Under 37 C.F.R. § 1.219
17. X Return Receipt Postcard
18.        Other: \_\_\_\_\_
19.        An Assignment of the invention to \_\_\_\_\_  
having an address of \_\_\_\_\_
- a.        is attached.
- b.        was recorded on \_\_\_\_\_ at Reel \_\_\_\_\_, Frame \_\_\_\_\_.
- c.        Applicant requests that the above assignee information be published with the application.
20. The power of attorney in the prior application is to:

\_\_\_\_\_  
Name of Attorney of Record\_\_\_\_\_  
Reg. No.\_\_\_\_\_  
The power appears in the original papers in the prior application.\_\_\_\_\_  
The power does not appear in the original papers, but was filed on \_\_\_\_\_.\_\_\_\_\_  
A new power has been executed and is attached.

21. Correspondence Address: Please address all future communications to:



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PATENT &amp; TRADEMARK OFFICE

Telephone: 248-358-4400; Fax: 248-358-3351

Respectfully submitted,

Barry Rosenbaum

Date January 9, 2003

James W. Proscia  
Name: James W. Proscia  
Registration No.: 47,010

\_\_\_\_\_  
X Attorney or agent of record  
Filed under Rule 34(a)

## ERASABLE INK FOR A WRITING IMPLEMENT

## BACKGROUND OF THE INVENTION

## 1. Field of the Invention

5 In at least one aspect, the present invention is related to erasable ink compositions that substantially simulate the appearance of a graphite pencil, and more particularly to erasable ink compositions that substantially simulate the appearance of a graphite pencil and are suitable for use in replaceable cartridges.

## 2. Background Art

10 For a number of years, there has been a desire to produce a pen that produces an erasable, pencil-like trace. Although a number of erasable ink compositions are known, attempts to make erasable ink compositions that substantially simulate the trace of a pencil have been plagued by difficulties related to the poor quality of the trace produced and to poor erasability. Notwithstanding the problems associated with the pencil-simulating compositions, ink compositions  
15 that are erasable with a typical pencil eraser are known. Generally, such compositions maintain erasability for at least several hours.

The erasable ink prior art includes erasable ink compositions that are both water-based and non-water based. The non-water based erasable ink formulations minimally contain a rubber, a pigment, and at least one solvent. For  
20 example, U.S. Patent Nos. 4,390,646 and 4,389,499, each disclose an erasable ink composition which includes a thermoplastic block copolymer, pigments, and a solvent. Preferably the copolymers are a mixture of radial and linear block copolymers. Similarly, U.S. Patent No. 4,721,739 (the '739 patent) discloses an erasable ink composition that contains a block polymer, a plasticizer, a lubricant,  
25 a colorant (i.e., a pigment), and a resin. Suitable plasticizers as set forth in the '739 patent are aliphatic esters such as butyl stearate and dioctyl adipate; or

aromatic esters such as dioctyl phthalate. These esters have a moderate molecular weight that is greater than 250.

5 The particular choice of pigments is important in maintaining the erasability of traces formed by the erasable ink composition. Moreover, the selection of an appropriate rubber (block polymer) dissolved in a solvent is such that when the solvent evaporates the ink viscosity increases to the point where further penetration of the ink to the paper is minimized. Unfortunately, these compositions are often plagued by clogging of the writing implement (i.e., the pen) over extended periods of time of non-use. This phenomenon tends to be somewhat worse when the ink is exposed to a humid environment. Accordingly, U.S. Patent No. 4,629,748 (the '748 patent) provides at least a partial solution to this problem by disclosing the utility of various dispersants in erasable ink compositions which contain rubber and non-aqueous solvents. Specifically, the '748 demonstrates the use of alkyl phosphate ester, amines, and oxyethylene-oxypropylene block copolymers.

15 Similarly, numerous water-based erasable ink compositions exist in the prior art. Typically, such aqueous compositions include a block copolymer such as styrene-butadiene and a pigment. Generally such compositions also include one or more additives such as releasing and spreading agents, antioxidants, surfactants, gelatinizers, lubricants, and various waxes.

20 Although many of the various prior art erasable ink compositions generally work to some degree, there is still a need for an improved erasable ink composition that produces tracings that substantially mimic the tracings of a pencil without substantially clogging the writing implement and without substantial breaks in the formed tracings. Moreover, there is also a need for a formulation that is capable of producing tracings that are for erasable for one or more days instead of the few hours which is typical of the prior art formulations.

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## SUMMARY OF THE INVENTION

The present invention overcomes at least one of the problems encountered in the prior art by providing an improved erasable ink composition particularly useful in a writing instrument that produces tracings substantially similar in appearance to tracings formed by a graphite pencil. Moreover, the composition of the present invention produces tracings that are substantially erasable with a common rubber pencil erasable for at least one day after the tracings are formed on paper. In at least one embodiment, the composition of the present invention comprises a solvent system, a rubber, and a pigment. The solvent system used in the present invention includes an organic ester and a component selected from the group consisting of an optionally substituted cycloalkane, an optionally substituted cycloalkanone, an optionally substituted cycloalkene, or mixtures thereof. The composition contains a sufficient amount of the solvent system so that the erasable ink composition will flow in a writing instrument. Finally, the erasable ink composition of the present invention optionally include one or more of the following:

- a plasticizer
- an additive selected from the group consisting of a corrosion inhibitor, a flow enhancing compound, and mixtures thereof; and
- a liquid butene polymer.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

Reference will now be made in detail to presently preferred compositions or embodiments and methods of the invention, which constitute the best modes of practicing the invention presently known to the inventors.

Except in the claims and the operating examples, or where otherwise expressly indicated, all numerical quantities in this description indicating amounts of material or conditions of reaction and/or use are to be understood as modified by the word "about" in describing the broadest scope of the invention. Practice within

the numerical limits stated is generally preferred. Also, unless expressly stated to the contrary: percent, "parts of", and ratio values are by weight; the term "polymer" includes "oligomer", "copolymer", "terpolymer", and the like; the description of a group or class of materials as suitable or preferred for a given purpose in connection with the invention implies that mixtures of any two or more of the members of the group or class are equally suitable or preferred; description of constituents in chemical terms refers to the constituents at the time of addition to any combination specified in the description, and does not necessarily preclude chemical interactions among the constituents of a mixture once mixed; specification of materials in ionic form implies the presence of sufficient counter-ions to produce electrical neutrality for the composition as a whole (any counter-ions thus implicitly specified should preferably be selected from among other constituents explicitly specified in ionic form, to the extent possible; otherwise such counter-ions may be freely selected, except for avoiding counter-ions that act adversely to the objects of the invention); and the term "mole" and its variations may be applied to elemental, ionic, and any other chemical species defined by number and type of atoms present, as well as to compounds with well defined molecules.

The term "cycloalkane" as used herein refers to cyclic saturated hydrocarbons having a ring of carbon atoms. A cycloalkane may be substituted with one or more substituents (i.e., optionally substituted.) Suitable substituents include, but are not limited to, lower alkyl, lower alkoxy, lower thioalkoxy, hydroxy, lower alkyl amino, amino, and nitro.

The term "cycloalkene" as used herein refers to cyclic hydrocarbons having a ring of carbon atoms with one or more double bonds. A cycloalkene may be substituted with one or more substituents (i.e., optionally substituted.) Suitable substituents include, but are not limited to, lower alkyl, lower alkoxy, lower thioalkoxy, hydroxy, lower alkyl amino, amino, and nitro.

The term "cycloalkanone" as used herein refers to cyclic saturated hydrocarbons having a ring of carbon atoms where at least one of the carbon atoms of the ring is doubly bonded to oxygen. A cycloalkanone may be substituted with



one or more substituents (i.e., optionally substituted.) Suitable substituents include, but are not limited to, lower alkyl, lower alkoxy, lower thioalkoxy, hydroxy, lower alkyl amino, amino, and nitro.

5       The term "lower alkyl" as used herein refers to a branched or straight hydrocarbon radical having from 1 to 6 carbon atoms and includes for example, methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, sec-butyl, tert-butyl, and the like.

      The term "lower alkoxy" as used herein refers to O-alkyl of from 1 to 6 carbon atoms as defined above for "lower alkyl."

10       The term "thioalkoxy" as used herein refers to S-alkyl of from 1 to 6 carbon atoms as defined above for "lower alkyl."

      The term "halogen" as used herein refers to fluorine, chlorine, bromine, or iodine.

15       The term "organic ester" as used herein refers to organic compounds formed by the reaction of a carboxylic acid and an alcohol.

      The term "phosphate ester" as used herein refers to compounds formed by the reaction of phosphoric acid ( $H_3PO_4$ ) and an alcohol. Included in this definition are compounds formed by the replacement of one, two, or three hydroxyl groups in phosphoric by alkoxyl.

20       The term "phthalic ester" as used herein means an ester of phthalic acid. Phthalic esters are often made by reacting phthalic anhydride with an alcohol in the presence of sulfuric acid.

      In an embodiment of the present invention, an erasable ink composition is provided. The erasable ink composition comprises:

25               a solvent system including:

a component selected from the group consisting of an optionally substituted cycloalkane, an optionally substituted cycloalkene, an optionally substituted cycloalkanone, and mixtures thereof; and

an organic ester;

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rubber; and

a pigment;

wherein a sufficient amount of the solvent system is added so that the erasable ink composition will flow in a writing implement. Typically, the erasable ink composition of the present invention will be provided in a reusable cartridge with the ink under a pressure from 25 psi to 35 psi. The solvent system is present in a sufficient amount so that the erasable ink composition has a viscosity from 20,000 cP to 60,000 cP at 25 °C. More preferably, the solvent system is present in a sufficient amount that the erasable ink composition has a viscosity from 30,000 cP to 50,000 cP at 25 °C; and most preferably the solvent system is present in a sufficient amount that the erasable ink composition has a viscosity of 40,000 cP at 25 °C. The compositions of the present invention produces tracings that are substantially erasable with a common rubber pencil erasable for at least one day after the tracings are formed on paper. Moreover, the compositions of the present invention produces tracings that are substantially erasable with a common rubber pencil erasable for a week or longer after the tracings are formed on paper.

The erasable ink composition of the present invention optionally include one or more of the following:

a plasticizer

an additive selected from the group consisting of a corrosion inhibitor, a flow enhancing compound, and mixtures thereof; and

25

a liquid butene polymer.

Many of the improved features of the present invention are attributable to the selection of the solvent system. The solvent system comprises a cyclic component selected from the group consisting of an optionally substituted cycloalkane, an optionally substituted cycloalkanone, and mixtures thereof; and an organic ester. In certain embodiments, the cyclic component is selected from the

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group consisting of optionally substituted cycloalkane having a 4 to 7 member ring, an optionally substituted cycloalkanone having a 4 to 7 member ring, an optionally substituted cycloalkene having a 4 to 7 member ring, and mixtures thereof. In other embodiments, the cyclic component is selected from the group consisting of cyclohexane, cyclohexanone, and mixtures thereof; and in certain preferred embodiments the cyclic component is cyclohexane. In certain embodiments, the organic ester is a low molecular weight organic ester with a molecular weight that is less than 250. In other embodiments, the organic ester has a molecular weight less than 200. In certain preferred embodiments, the organic ester is isobutyl butyrate.

As set forth above, in certain embodiments, the solvent system is present in a sufficient amount such that the erasable ink composition has a viscosity from 20,000 cP to 60,000 cP at 25 °C. Viscosity values in this range are typically obtained when the solvent system is present in an amount of 25% to 55% of the total weight of the erasable ink composition. More preferably, the solvent system is present in an amount of 35% to 45% of the total weight of the erasable ink composition; and most preferably, the solvent system is present in an amount of 40% of the total weight of the erasable ink composition. All percentages of the erasable ink composition as expressed in this document, unless otherwise stated, refer to the weight percentage of the stated component relative to the total weight of the erasable ink composition at standard temperature and pressure. The preferred solvent system comprises cyclohexane and isobutyl butyrate. In this variation, the cyclohexane is preferably present in an amount of 40% to 70% of the total weight of the solvent system, and the isobutyl butyrate is preferably present in an amount of 30% to 60% of the total weight of the solvent system. More preferably, the cyclohexane is present in an amount of 45% to 65% of the total weight of the solvent system, and the isobutyl butyrate is present in an amount of about 35% to 55% of the total weight of the solvent system; and most preferably, the cyclohexane present in an amount of 55% of the total weight of the solvent system; and isobutyl butyrate is present in an amount of 45% of the total weight of the solvent system.

The composition of the present invention further comprises rubber. Both synthetic and natural rubber and mixtures thereof are suitably included. In

certain embodiments, the rubbers are natural or synthetic rubbers that are copolymers of styrene and isoprene. Accordingly, these copolymer may be block copolymers, random copolymers, graft copolymers, or mixtures thereof. Preferably, the rubber is a block copolymer and more preferably, a block copolymer of styrene and isoprene. The rubber is preferably present in an amount of 10% to 40% of the total weight of the erasable ink composition. More preferably, the rubber is present in an amount of 15% to 25% of the total weight of the erasable ink composition; and most preferably the rubber is present in an amount of 20% of the total weight of the erasable ink composition. A particularly preferred rubber is Kraton™ D-1107 which is a styrene-isoprene-styrene block copolymer copolymer that includes an antioxidant, a stabilizer, and dusting agents. Kraton™ D-1107 is commercially available from Kraton Polymers located in Houston Texas.

The erasable ink of the present invention also includes a pigment. In certain embodiments, the pigment is a powder pigment wherein the powder particles have an mean particle diameter of 0.05 to 4 microns. In other embodiments, the pigment particles have a mean diameter of 0.5 to 3 microns; and in certain preferred embodiments the pigment particles have a mean diameter of 2 microns. Particularly useful powdered pigments comprise graphite powder, carbon black, and mixtures thereof. In certain embodiments, the powdered pigment is present in an amount of 2% to 25% of the total weight of the erasable ink composition. More preferably, the powdered pigment is present in an amount of 5% to 20% of the total weight of the erasable ink composition; and most preferably the powdered pigment is present in an amount of 12% of the total weight of the erasable ink composition. Particularly preferred pigments include graphite and carbon black. A particularly preferred pigment is synthetic graphite grade 48927 commercially available from Asbury Graphite mills located in Asbury New Jersey.

The erasable ink composition of the present invention also optionally includes a liquid butene polymer and a plasticizer. Suitable butene polymers include, but are not necessarily limited to, polybutene or copolymers of butene and isobutene. The plasticizer is preferably at least one phthalic ester. Preferred phthalic esters comprise dibutyl phthalate, dioctyl phthalate, and mixtures thereof.

In certain embodiments, the plasticizer is present in an amount of 5% to 25% of the total weight of the erasable ink composition. In other embodiments, the plasticizer is present in an amount of 10% to 20% of the total weight of the erasable ink composition; and in certain preferred embodiments, the at least one phthalic ester is present in an amount of 16% of the total weight of the erasable ink composition. In a particularly preferred embodiment of the present invention, the at least one phthalic ester is a phthalic ester mixture comprising dibutyl phthalate in an amount of 10% to 40% of the total weight of the phthalic ester mixture; and dioctyl phthalate in an amount of 60% to 90% of the total weight of the phthalic ester mixture.

The erasable ink composition of the present invention also optionally comprises an additive selected from the group consisting of a corrosion inhibitor, dispersants, a flow enhancing material, lubricants, resins, and mixtures thereof. Preferred corrosion inhibitors, include but are not necessarily limited to phosphate esters, and in particular to alkyl phosphate esters. A suitable phosphate ester is Rhodafac RS-410 commercially available from Rhodia HPCII. The corrosion inhibitor helps protect the metal components in the writing instrument (i.e., the pen) from the corrosive activity of the erasable ink composition. Moreover, phosphate ester may also improve dispersion of the ink over extended periods of time. The phosphate ester is present in an amount of 0.5% to 6% of the total weight of the erasable ink composition. More preferably, the corrosion inhibitor is present in an amount of 1% to 5% of the total weight of the erasable ink composition; and most preferably the corrosion inhibitor is present in an amount of 3% of the total weight of the erasable ink composition.

Although not limiting the practice of the invention to any particular mechanism of operation, the flow enhancing materials, the lubricant, and the resins function at least to some degree by allowing the viscosity of the erasable composition to be adjusted within the limits as set forth above. Preferred flow enhancing materials include mineral oil and glycerin. Suitable mineral oils include, but are not limited to, the Drakol<sup>TM</sup> line of mineral oils available from Pennzoil. Preferably, the flow enhancing materials are present in an amount of 0.5% to 6%

of the total weight of the erasable ink composition. More preferably, the flow enhancing material is present in an amount of 1% to 5% of the total weight of the erasable ink composition; and most preferably, the flow enhancing material is present in an amount of 3% of the total weight of the erasable ink composition. The composition of the present invention may also include one or more lubricants. If present, the lubricants are preferably present in an amount from 0.5% to 10% of the total weight of the erasable ink composition. More preferably, the lubricants are present in an amount from 1% to 5% of the total weight of the erasable ink composition; and most preferably, the lubricants are present in an amount of 2% of the total weight of the erasable ink composition. A particularly preferred lubricant is Penetek<sup>TM</sup> commercially available from JMN Specialties, Inc. located in Westwego, Louisiana.

The erasable ink composition of the present invention may also include an additive which is a resin. Such resins when used are preferably present in an amount from 0.1% to 3% of the total weight of the erasable ink composition. More preferably, such resins are present in an amount from 0.2% to 1% of the total weight of the erasable ink composition. A preferred resin is polyvinylpyrrolidone such as PVPK-30<sup>TM</sup> which is commercially available from BASF Corporation located in Wyandotte, Michigan.

The following non-limiting examples illustrate the various embodiments of the present invention. Those skilled in the art will recognize many variations that are within the spirit of the present invention and scope of the claims.

#### Example 1

The composition illustrated in Table 1 is prepared by mixing the components together.

Table 1. Weight percentages of erasable ink composition

Component	Weight %
-----------	----------

STYL 0162 PUS

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cyclohexane	22
isobutyl isobutyrate	18
Kraton Polymer D-1101	20
Dibutyl Phthalate	12
Diocetyl Phthalate	4
Rhodafac RS-410	3
Drakol Oil	3
Polybutene	6
Graphite (Grade 4827)	12

10

**Example 2**

The composition illustrated in Table 2 is prepared by mixing the components together. The premix is made in advance by combining 95 weight percent glycerin and 5 weight percent PVPK-30 prior to combining with the other ingredients.

15

Table 2. Weight percentages of erasable ink composition

20

Component	Weight %
cyclohexane	18
isobutyl isobutyrate	13
Kraton Polymer D-1101	18
Dibutyl Phthalate	5
Rhodafac RS-410	4
Drakol Oil	2
Polybutene	9
Glycerin	10

5

Premix of 95 weight percent glycerin and 5 weight percent PVPK-30	5
Penetek	2
Graphite (Grade 4827)	14

While embodiments of the invention have been illustrated and described, it is not intended that these embodiments illustrate and describe all possible forms of the invention. Rather, the words used in the specification are words of description rather than limitation, and it is understood that various changes  
10 may be made without departing from the spirit and scope of the invention.



## WHAT IS CLAIMED IS:

- 1                   1.     An erasable ink composition comprising:  
2                   a solvent system including:  
3                   a component selected from the group consisting of an optionally  
4 substituted cycloalkane, an optionally substituted cycloalkene, an optionally  
5 substituted cycloalkanone, and mixtures thereof; and  
6                   an organic ester;  
7                   a rubber; and  
8                   a pigment;  
9 the solvent system present in a sufficient amount that the erasable ink composition  
10 will flow in a writing implement.
- 1                   2.     The erasable ink composition of claim 1 wherein a sufficient  
2 amount of the solvent system is present so that the erasable ink composition has a  
3 viscosity from 20,000 cP to 60,000 cP at 25 °C.
- 1                   3.     The erasable ink composition of claim 1 wherein a sufficient  
2 amount of the solvent system is present so that the erasable ink composition has a  
3 viscosity from 20,000 cP to 60,000 cP at 25 °C.
- 1                   4.     The erasable ink composition of claim 1 wherein a sufficient  
2 amount of the solvent system is present so that the erasable ink composition has a  
3 viscosity from 30,000 cP to 50,000 cP at 25 °C.
- 1                   5.     The erasable ink composition of claim 1 wherein the solvent  
2 system comprises a component selected from the group consisting of an optionally  
3 substituted cycloalkane having a 4 to 7 member ring, an optionally substituted  
4 cycloalkanone having a 4 to 7 member ring, an optionally substituted cycloalkene  
5 having a 4 to 7 member ring, and mixtures thereof; and an organic ester.
- 1                   6.     The erasable ink composition of claim 1 wherein the solvent  
2 system comprises:

3 a component selected from the group consisting of cyclohexane,  
4 cyclohexanone, and mixtures thereof; and  
5 isobutyl butyrate.

1 7. The erasable ink composition of claim 1 wherein the solvent  
2 system is present in an amount of 25 % to 55 % of the total weight of the erasable ink  
3 composition.

1 8. The erasable ink composition of claim 1 wherein the solvent  
2 system is present in an amount of 35 % to 45 % of the total weight of the erasable ink  
3 composition.

1 9. The erasable ink composition of claim 1 wherein the solvent  
2 system is present in an of 40 % of the total weight of the erasable ink composition.

1 10. The erasable ink composition of claim 6 wherein the solvent  
2 system includes:  
3 cyclohexane present in an amount of 40 % to 70 % of the total weight  
4 of the solvent system; and  
5 isobutyl butyrate present in an amount of 30 % to 60 % of the total  
6 weight of the solvent system.

1 11. The erasable ink composition of claim 6 wherein the solvent  
2 system includes:  
3 cyclohexane present in an amount of 45 % to 65 % of the total weight  
4 of the solvent system; and  
5 isobutyl butyrate present in an amount of 35 % to 55 % of the total  
6 weight of the solvent system.

1 12. The erasable ink composition of claim 6 wherein the solvent  
2 system includes:  
3 cyclohexane present in an amount of 55 % of the total weight of the  
4 solvent system; and

5 isobutyl butyrate present in an amount of 45% of the total weight of  
6 the solvent system.

1 13. The erasable ink composition of claim 1 wherein the rubber  
2 is a natural or synthetic rubber.

1 14. The erasable ink composition of claim 1 wherein the rubber  
2 is a synthetic rubber which is a copolymer of styrene and isoprene.

1 15. The erasable ink composition of claim 1 wherein the natural  
2 or synthetic rubber is present in an amount of 10% to 40% of the total weight of  
3 the erasable ink composition.

1 16. The erasable ink composition of claim 1 wherein the rubber  
2 is present in an amount of 15% to 25% of the total weight of the erasable ink  
3 composition.

1 17. The erasable ink composition of claim 1 wherein the rubber  
2 is present in an amount of 20% of the total weight of the erasable ink composition.

1 18. The erasable ink composition of claim 1 wherein the pigment  
2 is graphite powder, carbon black powder, or mixture thereof.

1 19. The erasable ink composition of claim 1 wherein the pigment  
2 is present in an amount of 2% to 25% of the total weight of the erasable ink  
3 composition.

1 20. The erasable ink composition of claim 1 wherein the pigment  
2 is present in an amount of 5% to 20% of the total weight of the erasable ink  
3 composition.

1 21. The erasable ink composition of claim 1 wherein the pigment  
2 is present in an amount of 12% of the total weight of the erasable ink composition.

1                   22.    The erasable ink composition of claim 1 further comprising  
2 a component selected from the group consisting of:  
3                   a plasticizer;  
4                   an additive selected from the group consisting of a corrosion  
5 inhibitor, a flow enhancing compound, and mixtures thereof;  
6                   a liquid butene polymer; and  
7                   mixtures thereof.

1                   23.    The erasable ink composition of claim 22 wherein the additive  
2 comprise a corrosion inhibitor.

1                   24.    The erasable ink composition of claim 23 wherein the  
2 corrosion inhibitor comprises a phosphate ester present in an amount of 0.5% to 6%  
3 of the total weight of the erasable ink composition.

1                   25.    The erasable ink composition of claim 23 wherein the  
2 corrosion inhibitor is present in an amount of 1% to 5% of the total weight of the  
3 erasable ink composition.

1                   26.    The erasable ink composition of claim 23 wherein the  
2 corrosion inhibitor is present in an amount of 3% of the total weight of the erasable  
3 ink composition.

1                   27.    The erasable ink composition of claim 22 wherein the additive  
2 comprises a flow enhancing material.

1                   28.    The erasable ink composition of claim 27 wherein the flow  
2 enhancing material is a mineral oil present in an amount of 0.5% to 6% of the total  
3 weight of the erasable ink composition.

1                    29.    The erasable ink composition of claim 27 wherein the flow  
2 enhancing material is a mineral oil present in an amount of 1% to 5% of the total  
3 weight of the erasable ink composition.

1                    30.    The erasable ink composition of claim 27 wherein the flow  
2 enhancing material is a mineral oil present in an amount of 3% of the total weight  
3 of the erasable ink composition.

1                    31.    The erasable ink composition of claim 22 wherein the liquid  
2 butene polymer comprises a component selected from the group consisting of  
3 polybutene, a copolymer of butene and isobutene, and mixtures thereof.

1                    32.    The erasable ink composition of claim 22 wherein the  
2 plasticizer is at least one phthalic ester selected from the group consisting a dibutyl  
3 phthalate, dioctyl phthalate, and mixtures thereof.

1                    33.    The erasable ink composition of claim 32 wherein the at least  
2 one phthalic ester is present in an amount of 5% to 25% of the total weight of the  
3 erasable ink composition.

1                    34.    The erasable ink composition of claim 32 wherein the at least  
2 one phthalic ester is present in an amount of 10% to 20% of the total weight of the  
3 erasable ink composition.

1                    35.    The erasable ink composition of claim 32 wherein the at least  
2 one phthalic ester is present in an amount of 16% of the total weight of the erasable  
3 ink composition.

1                    36.    The erasable ink composition of claim 32 wherein the at least  
2 one phthalic ester is a phthalic ester mixture comprising:  
3                    dibutyl phthalate in an amount of 10% to 40% of the total weight of  
4 the phthalic ester mixture; and

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5                   dioctyl phthalate in an amount of 60% to 90% of the total weight of  
6   the phthalic ester mixture.

1                   37.    An erasable ink composition comprising:  
2                   a solvent system including:  
3                   a component selected from the group consisting of an optionally  
4   substituted cycloalkane, an optionally substituted cycloalkene, an optionally  
5   substituted cycloalkanone, and mixtures thereof; and  
6                   an organic ester;  
7                   at least one phthalic ester selected from the group consisting a dibutyl  
8   phthalate, dioctyl phthalate, and mixtures thereof.;  
9                   a rubber;  
10                  an additive selected from the group consisting of a corrosion  
11   inhibitor, a flow enhancing compound, and mixtures thereof;  
12                  a liquid butene polymer; and  
13                  a pigment;  
14   the solvent system present in a sufficient amount that the erasable ink composition  
15   will flow in a writing implement and the erasable ink composition has a viscosity  
16   from 20,000 cP to 60,000 cP at 25 °C.

1                   38.    The erasable ink composition of claim 37 wherein the solvent  
2   system comprises a component selected from the group consisting of an optionally  
3   substituted cycloalkane having a 4 to 7 member ring, an optionally substituted  
4   cycloalkanone having a 4 to 7 member ring, an optionally substituted cycloalkene  
5   having a 4 to 7 member ring, and mixtures thereof; and an organic ester.

1                   39.    The erasable ink composition of claim 37 wherein the solvent  
2   system comprises:  
3                   a component selected from the group consisting of cyclohexane,  
4   cyclohexanone, and mixtures thereof; and  
5                   isobutyl butyrate.

1                   40.    The erasable ink composition of claim 37 wherein the solvent  
2    system is present in an amount of 25 % to 55 % of the total weight of the erasable ink  
3    composition.

1                   41.    The erasable ink composition of claim 37 wherein the pigment  
2    is graphite powder, carbon black powder, or mixture thereof.

1                   42.    An erasable ink composition comprising:  
2                   a solvent system including:  
3                   cyclohexane present in an amount of 55% of the total weight of the  
4    solvent system; and  
5                   isobutyl butyrate present in an amount of 45 % of the total weight of  
6    the solvent system;  
7                   at least one phthalic ester selected from the group consisting a dibutyl  
8    phthalate, dioctyl phthalate, and mixtures thereof;  
9                   a rubber;  
10                  an additive selected from the group consisting of a corrosion  
11    inhibitor, a flow enhancing compound, and mixtures thereof;  
12                  a liquid butene polymer; and  
13                  a pigment;  
14    the solvent system present in a sufficient amount that the erasable ink composition  
15    will flow in a writing implement and the erasable ink composition has a viscosity  
16    from 20,000 cP to 60,000 cP at 25 °C.

1                   43.    The erasable ink composition of claim 42 wherein the solvent  
2    system comprises a component selected from the group consisting of an optionally  
3    substituted cycloalkane having a 4 to 7 member ring, an optionally substituted  
4    cycloalkanone having a 4 to 7 member ring, an optionally substituted cycloalkene  
5    having a 4 to 7 member ring, and mixtures thereof; and an organic ester.

1                   44.    The erasable ink composition of claim 42 wherein the solvent  
2    system comprises:

3 a component selected from the group consisting of cyclohexane,  
4 cyclohexanone, and mixtures thereof; and  
5 isobutyl butyrate.

1 45. The erasable ink composition of claim 42 wherein the solvent  
2 system is present in an amount of 25% to 55% of the total weight of the erasable ink  
3 composition.

1 46. The erasable ink composition of claim 42 wherein the pigment  
2 is graphite powder, carbon black powder, or mixture thereof.



## ABSTRACT OF THE DISCLOSURE

At least one embodiment of the present invention relates to an erasable ink composition particularly useful in a writing instrument for simultaneous the appearance of a graphite pencil. The composition of the present invention comprises a solvent system, a rubber and a pigment. The solvent system used in the present invention comprises an organic ester and a component selected from the group consisting of an optionally substituted cycloalkane, an optionally substituted cycloalkanone, an optionally substituted cycloalkene, or mixtures thereof. A sufficient amount of the solvent system is present so that the erasable ink composition will flow in a writing instrument. Finally, the erasable ink composition optionally includes a plasticizer, a liquid butene, or one or more additives selected from the group consisting of a corrosion inhibitor, a flow enhancing compound, and mixtures thereof.

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